The influence of teachers on students' decisions about choosing science: Comparing student and teacher perceptions

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ABSTRACT

This paper reports results from a study comparing teachers' and students' perceptions about the relative degree of influence parents, teachers, friends, older students and careers advisors have on students' decisions about enrolling in non-compulsory high school science subjects. The comparison was carried out as part of the *Choosing Science* project - a large-scale Australian study of 15 year-old students' experiences of school science and intentions regarding further participation. The study found that students considered their science teachers to have had the greatest influence, followed by parents and then friends. In contrast, however, science teachers believed their students to be most influenced in their decisions by friends and peers, followed by older students and siblings and parents, with teachers themselves having relatively little influence. Both groups believed that advice from careers advisors was of little influence. The findings are unique in the science education literature in providing an insight into differences and similarities in the perceptions of students and their teachers. In particular they indicate that teachers play a far greater role in students' decisions about enrolling in science than they believe. This has important implications for science teachers and teacher educators in terms of appreciating their influence and applying it in ways that encourage participation in science courses.

KEYWORDS: science participation, teacher influence, parent influence, peer influence,

1. Introduction

The ongoing concerns about declining STEM participation levels in many countries have led to investigations into a wide range of possible influences, including classroom pedagogy, student attitudes, perceptions of STEM careers, parental aspirations and sources of advice about science subjects and careers. This last area is quite contested, with research providing varied and sometimes contradictory findings about the relative influence of significant others on students' decisions. In one review of the international literature, Haeusler and Kay (1997) found Australian studies which concluded that parents are highly influential (e.g. Jones, 1990) as well as South African (Beukes, 1986) and UK (Garratt, 1985) research showing parents had little influence. Likewise, while some Australian studies reported peers as being highly influential (e.g. Jones, 1990; Suda et al., 1993), others from the US (Astin & Astin, 1992) and South Africa (Beukes, 1986) concluded peers are not very significant. A New Zealand review (Leach & Zepke, 2005) reported a similar diversity of results with respect to the influence of teachers. An Australian study (Warton & Cooney, 1998) rated careers advisors as one of the most useful sources of advice, whereas a Canadian study (Witko, Bernes, Magnusson & Bardick, 2005) concluded that students were often unsatisfied with the advice and information received from careers counsellors.

It is difficult to reconcile these diverse conclusions. It may well be that the relative influence of different individuals is simply culture-specific. Certainly, studies have shown that culture can affect the degree of influence parental advice or attitudes have on students' decisions (e.g. Rodrigues, Jindal-Snape & Snape, 2011). However, there are other differences between these studies that could also contribute to the diversity of opinion. First, they do not all involve students at the same stage of their education. The students in Astin and Astin's (1992) US study were in college and, as noted by McInerney and McInerney (1998), therefore more dependent on peers and less on parents than would be expected of younger students. More recent research tends to confirm the view that students at different stages of education attribute different levels of influence to teachers, parents and friends in decisions about STEM participation (e.g. Witko et al., 2005; Fouad, Hackett, Smith, Kantamneni, Fitzpatrick, Haag & Spencer, 2010).

A second explanation offered by Haeusler and Kay is that many students do not use the same criteria for selecting different subjects. Along with other authors (Ainley et al., 1994; Woolnough, 1994), they reported that career aspirations are a major consideration for those choosing physical sciences, though not for those taking creative arts. Haeusler and Kay also found that peer opinions were far more influential in the choice of creative arts subjects than in the physical sciences, where advice was sought mostly from parents and teachers. A similar pattern of consultation was reported by Anlezark, Lim, Semo and Nguyen (2008). A third possible reason for the diversity of findings could be the focus or phrasing of the questions. While some surveys ask about the general influence of various individuals, others ask about the influence of specific advice on subject choice, or about the quality of advice. As Sjaastad (2012) notes, the construct "influence" can be interpreted in a variety of ways and it is very difficult to disentangle general, long-term influences such as role modelling from context-specific influences such as expert advice.

The variety of conclusions found in the literature therefore cautions against generalising about the relative influence of significant others on enrolment decisions across countries, ages or contexts. Hence, rather than extrapolating from other studies it was important to conduct empirical research to address the following questions in regard to Australian Year 10 (15 year old) students' decisions about taking non-compulsory science subjects in Year 11:

1. Which people do Year 10 students consider the most influential in helping them make their decisions about choosing science in Year 11?
2. Which people do science teachers consider the most influential in Year 10 students' decisions about choosing science in Year 11?

The paper begins by outlining the *Choosing Science* study in general terms before detailing the how student responses were analysed. The findings relating to questions one and two are presented and the implications discussed with respect to Australian science education and the research literature more generally.

2. Methodology

The *Choosing Science* project (Lyons & Quinn, 2010) was a nationwide study of the influences on Year 10 students' decisions about whether or not to take science subjects in their final two years of high school. The students were from 200 schools selected for state/territory, school sector and geographical representation. They were in the final term of Year 10 and had recently chosen their subjects for Year 11. Students who had already decided to leave school rather than continue to Year 11 were excluded from the study. A total of 3801 students initially completed the online survey. Of these, 3759 responses were deemed fit for analysis. This sample constituted around 1.4% of all Australian Year 10 students and was reasonably representative of the overall Year 10 student population. Around 53% of the sample was female. Close to half the students attended capital city schools, while about 35% were from rural or remote areas. The government school sector was underrepresented (42% of sample compared to 61% nationally), while Independent school students were overrepresented (37% compared to 17% nationally) in the sample. Catholic sector representation (21%) was similar to the national proportion. Sample weighting was not considered necessary as there were no significant or substantial sector differences in the findings presented here.

Of the 3759 students, 908 (24%) had decided to take no science subjects in Year 11. Physics was chosen by 1007 students, chemistry by 1324, biology by 1331 and other sciences by 543. Note that some students chose to enrol in more than one science. Where this was the case, students were asked to focus on only one of their science subjects when responding to questions about their decisions. Those taking any combination that included physics were directed to respond in relation to physics. Those taking any combination including chemistry but not physics were directed to respond in relation to chemistry, while those taking biology and an "other science" were directed to respond in relation to biology.

Students were invited to respond to the following question: "How influential were the following people in helping you decide about choosing X?", where X was physics, chemistry, biology, other science or no science, depending on the students' decisions as outlined above. They responded by rating the influence of their mother, father, close friends, older students, recent science teachers, and careers advisors on Likert-type scales ranging from "not at all influential" to "very influential".

To provide a contrast to the students' perceptions, a sample of science teachers (N=589) were also asked for their opinions about the relative influence of these nominated persons on students' decisions. The teacher sample was reasonably representative of the Australian science teacher population, with around 56% teaching in government schools, 14% in Catholic schools and slightly less than 30% in Independent schools. Just over half the teachers

taught in capital cities, with around a third coming from rural or remote areas. About 16% of teachers had taught for less than five years, while more than half had been teaching for over 15 years.

Ratings were analysed in the first instance by comparing the percentages of respondents choosing each rating point on the items. In addition, the mean ratings and standard errors for each item were compared. Differences in mean ratings were considered significant ($p<0.001$) where there was no overlapping of standard error bars in accordance with Cumming and Finch, 2005).

3. Results

3.1 Students' perceptions of the influence of others

Students' overall mean ratings of the influence of different people are shown in Figure 1. Ratings above the mid-point of 2.5 indicate that the person was influential to some degree, while responses to the left of this value indicate that the students did not view the person in question as being influential in their decision. As shown in Figure 1, students believe that the most influential people were their science teachers, followed by their mothers and fathers. Least influential were careers advisers and older students.

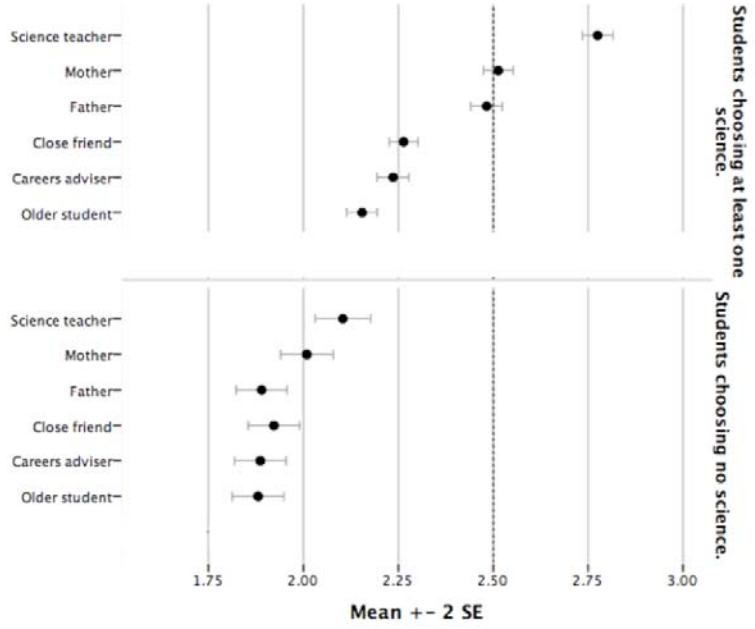

Figure 1: Mean agreement by "Science" and "No science" groups on the influence of people in helping them to decide about their science choices [Ratings on a scale from 1 (Not at all influential) to 4 (Very influential)].

The order of influence observed in the data was particularly distinctive among the students choosing at least one science. While this pattern was also apparent among those choosing no science there was a substantial degree of overlap between ratings. Nevertheless, among this group the mean rating for science teachers was still significantly higher than that of fathers, friends, career advisors and older students. It should be noted that while the science students were rating the influence of individuals on their decision to take a science (and on which science subject(s) to take), the non-science students were rating the relative influence of individuals on their decisions to take no science. Hence for these students a higher rating can

reasonably be interpreted as a more negative influence. It is clear therefore that relative to other nominated individuals, science teachers were considered be the most effective in terms of influencing students towards or away from engagement with further science.

3.2 Science teachers' perceptions of the influence of others

Figure 2 shows science teachers' mean ratings of the perceived influence of significant others. In contrast to the students, the teachers tended to believe that advice from students' friends and peers were the most influential, followed by advice from older students or siblings.

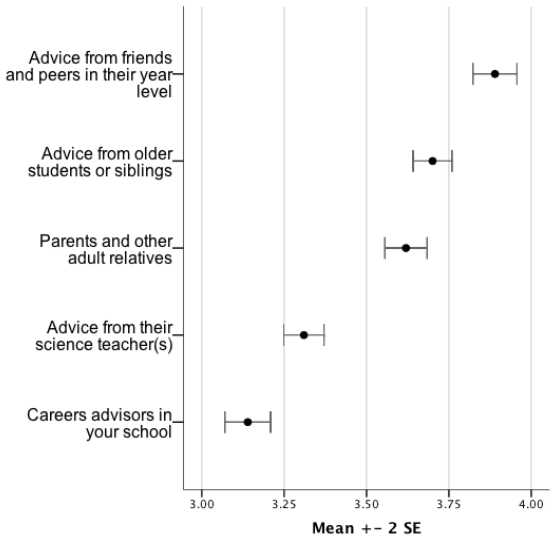

Figure 1: Science teachers' mean ratings of the influence of advice from a range of sources. [Response scale: 1=Not at all influential to 5 = extremely influential].

The advice of parents was seen by teachers as having less influence than advice from within students' own age group, though more so than that of the science teachers themselves. Teachers regarded the advice from Careers Advisers as having the least influence.

4. Discussion and Conclusions

The results show a striking contrast between the perceptions of students and teachers about the relative influence of various people in students' deliberations about science. Whereas students tended to believe that science teachers were the most influential people in their decisions, teachers themselves tended to downplay their own influence relative to friends and peers. From the students' point of view, however, friends and peers were less influential than adults. What teachers and students agreed on was the school careers advisors had relatively little influence in decisions about science subject choice. This is consistent with conclusions from other studies (e.g. Witko et al., 2005)

The difference in the perceptions of students and teachers about the impact of teachers is an important finding, as science teachers need to appreciate that they play a more influential role in students' enrolment decisions than they may assume. This has implications both for teaching practice and for our understanding of the role of science teachers in major life decisions taken by their students. First, it underscores what we already know about the importance of good teachers and good teaching in students' perceptions of particular subject areas. It highlights the need for classroom science teachers to be well informed about the

enormous breadth of science-related careers and post-compulsory school options, and to make this apparent in science classrooms. This may be facilitated by strategic collaboration and communication with school careers advisers who often have a broader knowledge base. It also points to the need for teachers to carefully consider the implications of their advice and opinions about science careers and students' potential.

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